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1. Untranslatable words are replaced with asterisks (\* \*\*).
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## **CLAIM + DETAILED DESCRIPTION**

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**[Claim(s)]**

[Claim 1] A tubular member which has the wall surface arranged between the 1st end and the 2nd end, this 1st end, and this 2nd end is provided, In a main part of a stent which has the 2nd extended diameter that is determined when this tubular member applies power extended on the radius outside from an inner side of the 1st diameter that enables arrangement in a lumen into a body passage which has a lumen for this tubular member, and this tubular member, A stent, wherein the film of this wall surface is carried out with a pliability polymer film of a thin film in which two or more detailed holes were punched.

[Claim 2] this detailed hole -- abbreviated -- a stent of Claim 1 which sets a uniform interval and is arranged.

[Claim 3] Claim 1, wherein said wall surface consists of a crossing long and slender member of metal plurality, or 2 stents.

[Claim 4] Any 1 stent of Claims 1-3, wherein said pliability polymer film is a segmentation polyurethane polymer film.

[Claim 5] Any 1 stent of Claims 1-3, wherein said detailed hole has a diameter of 5-500 micrometers at intervals of 50-500 micrometers by controlling an excimer laser or carbon dioxide laser by computer.

[Claim 6] Any 1 stent of Claims 1-3, wherein said segmentation polyurethane polymer film has a thickness of 10-100 micrometers.

[Claim 7] Any 1 stent of Claims 1-3 characterized by what a segmentation polyurethane polymer film in which said detailed hole was punched was further fixed for by biodegradation nature polymer.

[Claim 8] A stent of Claim 7 containing a medicine in biodegradation nature polymer which coated a segmentation polyurethane polymer film in which said detailed hole was punched.

[Claim 9] A stent indicated to Claim 8, wherein a medicine contained in said biodegradation nature polymer is chosen from heparin, hirudin, and argatroban.

[Claim 10] A mandrill for cover strips is dried after polymer fluid is impregnated, A cover strip of a thin film is created by extracting this mandrill, A mandrill for stents which equipped with a stent after it sent gas in this cover strip and this cover strip had fully opened is inserted into this cover strip, By stopping gaseous ventilation, this cover strip contracts and it is stuck by peripheral part of a stent, How to manufacture a stent which cut off this cover strip of a stent portion and in which the film was carried out by cover strip of a polymer film, and to manufacture a stent which removes a stent from a mandrill for stents after that and which was covered by process with a polymer film.

[Claim 11] after creating said cover strip -- laser -- abbreviated -- a method of manufacturing a stent

covered with a polymer film of Claim 10 providing further a process in which a detailed hole is punched in a uniform interval.

[Claim 12]How to manufacture a stent covered with Claim 9 or a polymer film of Claim 11, wherein said polymer fluid is segmentation polyurethane polymer solution.

[Claim 13]How to manufacture a stent covered with Claim 10 or a polymer film of 11, wherein it sticks a diameter of said cover strip to the perimeter of a main part of a stent according to a thing small more slightly than a diameter of a main part of a stent by which a film is carried out by that cause and a film is carried out.

[Claim 14]How to manufacture a stent covered with Claim 10 or a polymer film of 11, wherein contraction of said cover strip sticks to a peripheral part of a main part of a stent by a process of thermal melting arrival further and a film is carried out.

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## [Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the piece of the transplant in a lumen (henceforth a "stent") used for a surgical operation, especially a coronary-arteries operation in recent years. It is related with the method of manufacturing the stent covered with the stent covered in the perimeter of the main part of a stent in detail with the polymer film which has pliability, and its polymer film. It is related with the art of making this polymer film containing a chemical substance like a medicine, and making a curative medicine emitting to a treated area and of using a stent for what is called "drug delivery."

[0002]

[Description of the Prior Art]The medical treatment of ischemic heart disease had the conventionally common method of carrying an intravascular lumen to through, for example, a strangulation part, for percutaneous transluminal coronary angioplasty (PTCA), i.e., a balloon catheter, making extend a balloon with a fluid like a physiological saline after that, and treating. However, the establishment which the crown blockade of an acute term and strangulation (what is called re-strangulation) of a PTCA enforcement part for the second time produce in this method was high. In order to solve these problems, the piece of the transplant in a lumen called a stent is developed, and it is put in practical use rapidly these days, and has spread. According to the latest data, placing and changing to the operation which already uses a stent about 40% of the operations by a balloon catheter is shown.

[0003]By being carried through the inside of lumina, such as a blood vessel, and extending the diameter in the treated area of a lumen, the main part of a stent is a piece of the transplant in a lumen supported by the operation from an inner side. A stent can be used for other lumen parts of human bodies, such as a \*\*\*\* pipe, a ureter, an oviduct, an aortic aneurysm, a peripheral artery, a renal artery, a carotid artery, and a cerebral blood vessel, although a coronary-arteries operation is explained to a subject here, since it is mostly used to the coronary-arteries operation mainly mentioned above now. In order to understand especially this invention, it is expected that the field of the invention of a stent spreading increasingly and a future stent are used by many operations and that the importance of a super-thin stent increases with use in the field of brain surgery.

[0004]Although there are a self-extension type thing and a model extended by the means of a balloon catheter etc. in the main part of a stent, It is called "balloon expander bull stent" which is a model which a balloon catheter is equipped with a stent and extended by a balloon catheter to be used widely in recent

years. JP,H4-6377,B is indicating the main part of a balloon expander bull stent which Dr. PAL MATTSU develops and is sold with the trademark of the present "PAL MATTSU Schutt." As shown there, the main part of a stent possesses the tubular member which has the wall surface arranged between the 1st end and the 2nd end, the 1st end, and the 2nd end, This wall surface is formed of two or more crossing long and slender members, a balloon catheter is equipped with it in the 1st state where it contracted to the radial direction of this tubular member, the inside of a lumen is carried to a strangulation part, and after being extended to the 2nd extension state, it is constituted so that it may be detained in the part. The main part of a stent put in practical use in this way is manufactured by carrying out laser etching of the cylinder pipe usually made with metal, such as stainless steel.

[0005]Re-strangulation can be prevented now by leaps and bounds by the spread of the operations using a stent. However, on the other hand, since the main part of a metal stent is a foreign substance in the inside of the body, let it be the biggest technical problem [ in / in the thrombosis whose symptoms are shown within several weeks after the main part insertion of a stent / stent medical treatment ]. That is, since the metal stent itself has thrombus nature, if it is exposed to blood, plasma proteins, such as albumin and fibrinogen, will be contacted and condensation will occur from adhesion of blood platelets. By detaining the main part of a metal stent, multiplication of vascular endothelium is urged and there is also indication that one this also causes re-strangulation. For this reason, coating the surface of the main part of a metal stent with a medicine with anticoagulant effects, such as heparin, coating by polymer, or making the stent itself from polymer etc. is proposed.

[0006]

[Description of the Prior Art]The stent in which the film layer which JP,H7-24072,A becomes from a 4 fluoridation ethylene resin porous body film is provided is proposed. In JP,H8-224297,A, the stent around which the even sheet of the polymer material is wound in the shape of a coil is proposed. The stent which carried out the film by expansion polytetrafluoroethylene is shown by JP,H9-173467,A. However, there was that [ no ] by which that the concept of covering the surface of these metal stents by low polymer resin of anti-thrombus nature was indicated to be was still commercialized. If the main part of a stent is covered completely, even if inner skin-ization of a cell will be checked and porosity resin will only be conversely used for the Reason, there is in the \*\* thickness (fault multiplication of a smooth muscle cell) of the lining membrane of that into which a cell can enter having progressed too much, and re-strangulation having occurred. The stent aiming at prevention of re-strangulation is proposed by making JP,H6-86827,A from living body absorption polymer textiles. In these prior arts, a balloon catheter is equipped in the 1st state that is the feature of the stent mentioned above where it contracted to the radial direction of the tubular member, the inside of a lumen is carried to a strangulation part, and after being extended to the 2nd extension state, the point detained in the part is not fully taken into consideration. That is, in the film layer which consists of a 4 fluoridation ethylene resin porous body film shown by JP,H7-24072,A, since it is inelastic, when it is extended to the 2nd extension state, the film layer has been torn. In the sheet of the polymer material currently rolled in the shape of [ which is shown by JP,H8-224297,A ] a coil, when extended to the 2nd extension state, it might be said that the coil-like sheet currently rolled will come loose.

[0007]Although it is proposed in the invention shown by JP,H8-196643,A that a tubed cover member is porosity, After mixing and fabricating the solid particles of predetermined particle diameter in polymer materials as a method of manufacturing the porous thing, although particles dissolve, polymer is made suitable [ the method of being immersed in an insoluble solvent and removing solid particles ].

However, in such a method, porous density, the size of a diameter, the position of the hole, etc. were not able to be controlled. Even if it saw which prior art, what indicated the manufacturing method of the metal stent covered by polymer resin was not seen.

[0008]on the other hand -- the segmentation polyurethane polymer film of a thin film -- abbreviated, [ a uniform interval ] [ a detailed hole ] [ the punched artificial blood vessel ] [ make and ] It is reported that the good result was obtained (Journal.). Are with the artificial blood vessel by which the detailed hole from which of Biomedical Materials Research, Vol.31, 27-33/Vol.31,235-242/Vol.34,361-370., especially a size differ was punched, and. [ multiplication of endothelial cells ] According to the tested result, it was checked that endothelial cells increase to the opposite side of an artificial blood vessel through a detailed hole. However, to the last, these artificial blood vessels are the lumina of the shape of a tube made from the polyurethane polymer film, and the purpose and composition differ from this invention which is covered by the main part of a metal stent and is inserted into a lumen.

[0009]

[Problem to be solved by the invention]There is this invention in developing the stent covered with the polymer film which solved the conventional problem which was described above. It is in impregnating such a polymer film with a medicine and emitting to it within a lumen. Another polymer layer which impregnated the surface of the polymer film with the medicine is fixed preferably, and it is in emitting within a lumen. It is in providing metal stents with a mass-production target and the manufacturing method coated economically about such a polymer film.

[0010]

[Means for solving problem]The inner surfaces, i.e., the portion in contact with blood, such as a blood vessel, are covered with the cell layer called endothelial cells among the body tissue. In order that this endothelial cell may secrete that that surface is covered with sugar, and the substance in which the endothelial cell itself suppresses activation of blood platelets like a prostagladin, in a body tissue, a thrombus etc. cannot get up easily. There is a place which this invention means in making the surface of the main part of a metal stent into the structure where it is covered by endothelial cells and reconstruction of a normal blood vessel wall organization takes place easily, in order to make metal stents into the thing near a body tissue as much as possible. By doing so, anti-thrombus nature is obtained with the characteristic of the endothelial cells which covered the surface, and the metal stents which conquered the weak point of the main part of a metal stent are provided.

[0011] [ by this invention person's providing a predetermined hole by the method controlled by specific polymer, as a result of inquiring that these problems should be solved, and coating the main part of a metal stent with the polymer film ] It found out that inner skin-ization of a moderate cell could be promoted and thrombus nature could be fallen. That is, the tubular member which has the wall surface arranged between the 1st end and the 2nd end, this 1st end, and this 2nd end is provided, In the main part of a stent which has the 2nd extended diameter that is determined when this tubular member applies the power extended on the radius outside from the inner side of the 1st diameter that enables arrangement in a lumen into the body passage which has a lumen for this tubular member, and this tubular member, The stent to which the film of this wall surface was carried out with the segmentation polyurethane polymer film of the thin film in which two or more detailed holes were punched is provided.

[0012]The metal in which the main part of a stent used by this invention has biocompatibility preferably is used. Usually, stainless steel, titanium, tantalum, aluminum, tungsten, and nitinol are illustrated as metal with the biocompatibility used for medical implements. The processability to stainless steel is

preferred. The balloon expander bull stent specifically sold from Johnson & Johnson Medical, Inc. with the trademark of "PAL MATTSU Schutt", What kind of stents, such as the "MULTI-LINK" stent of ACS, "GR2" stent of Cook, the "Caux De Dis" stent of Caux De Dis, and the "micro stent GFX" stent of AVE, may be sufficient.

[0013]although a detailed hole may be arranged at random -- desirable -- abbreviated -- a detailed hole is punched at a uniform interval. abbreviated -- that a detailed hole is punched at a uniform interval means being arranged at interval of about 1 law not by the meaning that an interval is the same but by the method by which the interval of the detailed hole was controlled therefore -- abbreviated -- when it glances at a uniform interval, arrangement etc. of the shape of slant which seems to be arranged at random, the shape of a circle, and the shape of an ellipse are included. As long as it is a size which endothelial cells can frequent, what kind of size and shape may be sufficient as a detailed hole. 5-500 micrometers of diameters are 20-100-micrometer round shapes most preferably. It cannot be overemphasized that other shape, such as an ellipse form, a square, and a rectangle, is included. These are the things in the state before being extended, when the main part of a stent is extended and it is detained in a lumen, a round shape changes into long ellipse type, and a diameter also changes according to it.

[0014]A thing important when arranging a detailed hole is the density of the detailed hole to the pliability polymer film which carries out a coat. If too high-density, the intensity of a polymer film will fall, and if multiplication of endothelial cells progresses too much and it is too low-density, the multiplication to the stent inner side of endothelial cells will not fully be produced. controlling this density -- abbreviated -- it is a uniform interval -- abbreviated -- it is easily carried out by arranging the detailed hole which has a uniform size. From the ability of a desired interval and the detailed hole of a size to be set up by changing setting of an interval and a size, the detailed hole of the density of hope can be arranged by designing beforehand.

[0015]A detailed hole is arranged on 50-500 micrometers and two or more desirable straight lines at the interval of 100-300 micrometers, for example. For example, two or more of these straight lines have been arranged at intervals of a predetermined, fixed angle in the direction of an axis of a stent, they consist of 10-50 straight lines.

[0016]Although it does not limit especially as a material used as a pliability polymer film of a stent, The high polymer elastomer of pliability is preferred and For example, a polystyrene system, Various elastomers and those copolymers, or those polymer alloys, such as a polyolefin system, a polyester system, a polyamide system, a silicone series, a urethane system, a fluorine resin system, and a crude rubber system, can be used. Also especially in them, pliability is high and strong segmented polyurethane of intensity is the optimal.

[0017][ film / which is used by this invention / segmentation polyurethane polymer ] It is preferred that it is what it has a polyether portion flexible as a soft segment and a portion with aromatic rings and UREA combination abundant as a hard segment, and this soft segment and hard segment carry out phase separation, and is making detailed structure. Such a segmentation polyurethane polymer film has sufficient machinery physical properties, and it is excellent also in anti-thrombus nature. That is, there is biocompatibility, and it can elongate enough, without fracturing, also when a stent is moreover extended to the 2nd diameter from the 1st diameter.

[0018]what this invention controls and controls an excimer laser, carbon dioxide laser, or various semiconductor lasers by a computer for -- abbreviated -- the art which punches a detailed hole at a

uniform interval is provided. It provides that the segmentation polyurethane polymer film used by this invention uses what has a thickness of 10-100 micrometers. It is 20-50 micrometers suitably. It is preferred to have thickness.

[0019] Since the main part of a stent used by this invention is carried and detained in all lumina in the living body, the size of the stent itself is considered from a 40-mm-long long thing to an about 2-3-mm very small thing which is sent into a cerebral blood vessel. The diameter of the small thing is also very as thin as about 0.5-1 mm. Therefore, although the segmentation polyurethane polymer film used by this invention has very thin thickness, the characteristic that intensity of enough is required. Since the stent coated by this polymer has inside of a thin lumen like a cerebral blood vessel carried, the outside surface needs to have a smooth structure without a projection so that inner organizations, such as a blood vessel, may not be wounded.

[0020] This invention includes coating the segmentation polyurethane polymer film in which said detailed hole was punched by biodegradation nature polymer. This invention can impregnate the biodegradation nature polymer which coated the segmentation polyurethane polymer film in which said detailed hole was punched with curative medicines, such as an anti-blood platelet agent, a vanti-thrombotic, and a multiplication prevention agent, in order to prevent re-strangulation and thrombosis. Specifically Heparin, low-molecular quantity heparin, hirudin, argatroban, Forma KORIN, BAPIPUROSUTO, pro SUTAMORIN, a pro SUTAKIRIN family object, Dextran, low FEPUROARUGU chloromethyl ketone, a day PIRIDA mall, The blood platelet film receptor antibody of glycoprotein, rearranged type hirudin, a thrombin suppression agent, Pulse pipe PEPUCHIN, a pulse pipe Tianjin conversion enzyme repression agent, steroid, a fibroblast growth factor antagonist, Although medicines, such as fish oil, omega 3-fatty acid, histamine, an antagonist, a HMG-CoA reductase depressant, SERAMIN, a serotonin prevention antibody, a CHIOPURO teeth depressant, bird MAZORUPIRI Demin, and interferon, are mentioned, It should not be limited to these.

[0021] The segmentation polyurethane polymer film in which said detailed hole was punched as for this invention may be coated by lubricative polymer in the outside surface, in order to make smooth movement within the fine blood vessel in a human body. As such lubricative polymer, polyethylene glycols, polyacrylamide, poly vinyl pyrrolidone, etc. are raised.

[0022] On the other hand, this invention provides the method of manufacturing commercially the stent covered with the polymer film. That is, the mandrill for cover strips is dried after polymer fluid is impregnated, Extract this mandrill and the cover strip of a thin film is created by things, The mandrill for stents which equipped with the stent after it sent gas in this cover strip and this cover strip had fully opened is inserted into this cover strip, By stopping gaseous ventilation, this cover strip contracts and it is stuck by the peripheral part of a stent, How to manufacture the stent which cut off this cover strip of the stent portion and in which the film was carried out by the cover strip of the polymer film, and to manufacture the stent which removes a stent from the mandrill for stents after that and which was covered by a series of processes with the polymer film is shown.

[0023] after this invention creates said cover strip -- laser -- abbreviated -- the manufacturing method which provided further the process in which a detailed hole was punched in the uniform interval is provided. This invention provides the manufacturing method which provided further the process in which a detailed hole was punched at the same time it extracts a mandrill and creates the cover strip of a thin film by things by providing a detailed projection in the surface of the mandrill for cover strips beforehand. This invention contains the manufacturing method using the segmentation polyurethane

polymer solution in which said polymer fluid consists of organic solvents, such as dioxane and a tetrahydro franc. This invention contains the manufacturing method by making the diameter of said cover strip slightly smaller than the diameter of the stent by which a film is carried out by that cause. This invention also contains the manufacturing method which contraction of said cover strip sticks to the peripheral part of the main part of a stent by the process of thermal melting arrival further.

[0024]

[Working example]Drawing 1 shows the main part 10 of a metal stent of the state of the example of the main part of a metal stent used for this invention, especially the 1st diameter before [ that ] extending. This main part 10 of a metal stent is 2 cm in 4 mm and length, and 0.2 mm in thickness in diameters, for example. As this main part of a stent, the balloon expander bull stent currently sold from Johnson & Johnson Medical, Inc. with the trademark of "PAL MATTSU Schutt" can also be used.

[0025]Drawing 2 is a side view of the main part 10' of a metal stent of the state of the 2nd diameter after extending. This diameter of this main part 10' of a metal stent is 2 cm in 8 mm and length, and 0.2 mm in thickness, for example. When this main part of a metal stent applies the power extended on the radius outside from the inner side of this tubular member, a diameter changes from the 1st diameter to the 2nd diameter, so that I may be understood from now on. In this example, it extended to 8 mm 200% from 4 mm.

[0026]The film of this wall surface is carried out to the whole perimeter on the surface of a wall which constitutes the main part of a metal stent of drawing 1 as follows with the segmentation polyurethane polymer film of a thin film. Many opening portions are provided in the main part of a metal stent, and a polymer film carries out the film of the main part of a metal stent, and its opening portion.

[0027]the segmentation polyurethane polymer film of a thin film -- the mixed solution of a tetrahydro franc and dioxane -- Capdiomat(trademark) SPU:. [ the 10 weight % solution of segmented polyurethane (product made from Kontoron CardiovascularInc.) ] After impregnating with the mandrill of glass, air cooling was carried out, and the 100-micrometer-thick cylindrical SPU film was prepared.

[0028]this SPU film -- an excimer laser -- for example, a hole 100 micrometers in diameter -- the interval of 200 micrometers -- abbreviated -- put on uniformly -- \*\*. put on an one-row hole to a major axis direction -- after \*\* and a SPU film -- a circumference top -- for example, rotate 15 degrees at a time and put on the hole of 24 rows on all the circumferences -- \*\*.

[0029]This \*\*\*\* used with the laser device of the Hamamatsu Photonics model L4500, and was performed. The excimer laser generator 12, the TV monitor 14, the computer 16, and the micro processing unit 18 are provided, and a laser output is 248 nm as this laser was shown in drawing 3. controlling automatically the mandrill in which the cylindrical SPU film appeared with this laser device by computer on a X-Y-Z axis -- exact -- again -- efficient -- abbreviated -- the detailed hole was punched at the uniform interval. The size of a diameter can be created in 5-100 micrometers by using the photomask of an output and a request. Change of a computer program can also perform easily distance of the hole of a major axis direction, the distance of a hole and the hole on the circumference, and a hole. Thus, the stent 20 as the film of the created cylindrical SPU film was carried out to the whole perimeter on the surface of a wall which constitutes the main part of a metal stent and it was shown in drawing 4 was created. the interval whose hole of actual arrangement of a detailed hole [ in / drawing 4 - 6 are simple figures, and arrangement of the detailed hole is shown simple, and / this work example ] 100 micrometers in diameter is 200 micrometers at the above-mentioned cage, for example -- abbreviated --

it is arrangement of 24 rows on all the circumferences uniformly. In the passage with this stent 20 clear from (b) of [drawing 4](#) which is an expanded sectional view, the punched detailed hole has penetrated the SPU film 19. It is lost that wrap in the surface of the main part of a metal stent at the same time endothelial cells enter inside the main part of a metal stent through this detailed hole, therefore the metal part which is a foreign substance contacts human body organizations, such as blood, directly. This main part of a metal stent changed to the 2nd state where it extended in the treated area as it was mentioned above, but in the state where it extended as shown in [drawing 5](#), although the shape of the detailed hole changed, since it was fully elastic, this cylindrical SPU film was not fractured. Even if this cylindrical SPU film carries out the film of the main part of a metal stent as it is, it prevents a thrombus and can prevent unusual breeding of endothelial cells, but being coated with a living body absorption polymer is desirable as shown in [drawing 6](#). For example, the coat of the gelatin with light response nature is carried out, and it can coat with flushing back the thing which is not polymerized [ which was polymerized with UV light ]. As for this thickness, about 5 micrometers is preferred. This living body absorption polymer can be made to contain various curative medicines. As such a curative medicine, a vanti-thrombotic like heparin is preferred. As shown in the expanded sectional view of (b) of [drawing 6](#), the detailed hole of the SPU film 19 is temporarily closed by the coating layer 21 of this living body absorption polymer.

[0030]Next, with reference to [drawing 7](#), the manufacturing method which manufactures the stent covered with the polymer film is explained.

[0031]This manufacturing method Are impregnated to the polymer fluid of the mandrill for cover strips ([drawing 7 \(a\)](#)), Dryness and punching ([drawing 7 \(b\)](#)), creation of the cover strip of the thin film by extracting a mandrill ([drawing 7 \(c\)](#)), The state where gas was sent in support ([drawing 7 \(d\)](#)) of the main part of a stent, and a cover strip, and this cover strip fully opened, Insertion into this cover strip of the mandrill for stents equipped with a stent ([drawing 7 \(e\)](#)), The adhesion to the peripheral part of the stent of the cover strip by stopping gaseous ventilation and shrinking this cover strip, and cutoff of this cover strip of a stent portion ([drawing 7 \(f\)](#)), It has a series of processes in which removal ([drawing 7 \(g\)](#)) of a stent is included, from the completion of a stent in which the film was carried out by the cover strip of the polymer film, and the mandrill for stents.

[0032]The mandrill 22 for cover strips shown in [drawing 7 \(a\)](#) is a rice cake \*\*\*\* thing, in order to make the cover strip 24 ([drawing 7 \(b\)](#)) of a thin film around this, and it is the pillar which has desired thickness beforehand and was suitably made by stainless steel. the main part of a stent in which the film of this thickness is carried out -- abbreviated -- it has the same diameter or a diameter slightly smaller than it. As shown in [drawing 7 \(a\)](#), [ the mandrill 22 for cover strips ] When holding a cover strip, and when the direction designed have a diameter thicker than a tip part in the actual condition by the side of a tip succeeding the portion used for a stent film pours in gas (for example, air), it is convenient.

[0033]The polymer fluid 26 is impregnated in this mandrill 22 for cover strips, and a mandrill is pulled up after carrying out the coat of the polymer to the whole circumference of a mandrill.

[0034]Especially the kind of polymer used with this manufacturing method can use various elastomer system polymer, without being limited. Specifically, a polyurethane elastomer, a polyester elastomer, a polyamide elastomer, a polyethylene elastomer, a polypropylene elastomer, and a polyethylene terephthalate elastomer are raised. Especially, since it has elasticity and intensity with moderate segmentation polyurethane polymer, it is the most desirable.



[0035]Natural seasoning of the polymer by which the coat was carried out is carried out as shown in drawing 7 (b). Depending on the kind of polymer, it can dry of the cold style.

[0036]having held the polymer by which the coat was carried out by the mandrill for cover strips, after dryness finished -- laser -- abbreviated -- a detailed hole is punched at uniform interval. As laser, if it is carbon dioxide laser or an excimer laser, all can be used, but preferably, since the average output is large, an excimer laser is suitable. Even if this laser moves a probe portion to the circumference of the mandrill for cover strips, it oscillates laser simultaneously from two or more laser, and can also punch a detailed hole. Anyway, a motion of this laser is controlled by the soft program set up beforehand, and can punch the hole of a desired size at a desired interval.

[0037]A cover strip is done by extracting the mandrill for cover strips, with the base material 28 held as shown in drawing 7 (c).

[0038]Next, the mandrill 30 for stents in the state where it equipped with the main part 10 of a stent is inserted into the cover strip 24 as shown in drawing 7 (d). The mandrill 30 for stents in the state where it equipped with the main part 10 of a stent does not need to be prepared specially. Because, in usually manufacturing the main part 10 of a stent. Since it is manufactured by supporting the pillar of metal, such as stainless steel, to the mandrill 30 for stents, and starting an unnecessary portion with the technique of laser etching of the metal pillar, it continues as it is from the main part manufacturing process of a stent, and can go into this process. Such a manufacturing method is explained by JP,H4-6377,B and JP,H6-181993,A in full detail.

[0039]In order to insert the mandrill 30 for stents, and the main part 10 of a stent into this cover strip 24 and to carry out them as shown in drawing 7 (e), It will be easy to insert, if this cover strip 24 changes into the state where it fully opened, by sending in gas as the arrow showed in the cover strip 24. It is desirable at that of since it will always fully be opened by the cover strip since the ventilated gas escaped from and came out of this detailed hole in the case of the cover strip 24 punched in the detailed hole, and a detailed hole is also fully opened simultaneously.

[0040]Since the diameter of the cover strip 24 is set up more slightly than the diameter of the main part 10 of a stent by which a film is carried out preferably by that cause, By stopping sending in gas in the cover strip 24 so that it may be obvious, the cover strip 24 contracts and it is stuck by the peripheral part of the main part 10 of a stent. Under the present circumstances, by sending the gas heated further, adhesion to the peripheral part of the main part 10 of a stent may be ensured by thermal melting arrival.

[0041]Next, if this cover strip of a stent portion is cut off and an unnecessary polymer film is removed as shown in drawing 7 (f), the stent 20 the film was carried out [ the stent ] by the cover strip will be made.

[0042]Then, if the mandrill for stents is extracted, the stent 20 covered with the polymer film will be manufactured as shown in drawing 7 (g).

[0043]By controlling by a computer, these processes of a series of should be easily understood, if it is a person skilled in the art that it is completely automatable. A process can also be further added to the manufacturing process as above-mentioned as occasion demands. For example, after polymer fluid is impregnated in the mandrill for cover strips, a living body absorption polymer layer can be further coated by impregnating living body absorption polymer solution. After polymer fluid is impregnated, a polymerization can also be promoted and coated by ultraviolet rays etc. For example, if a curative medicine is blended into the above-mentioned living body absorption polymer solution, a curative

medicine will be emitted to the inside of the body with decomposition of this polymer. It cannot be overemphasized by calculating the kind of this living body absorption polymer, a molecular weight, the thickness of coating, etc. that the time when a curative medicine is emitted to the inside of the body, and a period can be designed.

[0044]As such a living body absorption polymer, there are gelatin, polylactic acid, polyglycolic acid, KAPURO lactone, a lactic acid-glycolic acid copolymer, poly GLOKISANON, a kitchen, etc. As a curative medicine blended, heparin, low-molecular quantity heparin, hirudin, Argatroban, forma KORIN, BAPIPUROSUTO, pro SUTAMORIN, A pro SUTAKIRIN family object, dextran, low FEPUROARUGU chloromethyl ketone, A day PIRIDA mall, the blood platelet film receptor antibody of glycoprotein, rearranged type hirudin, A thrombin suppression agent, pulse pipe PEPUCHIN, a pulse pipe Tianjin conversion enzyme repression agent, steroid, A fibroblast growth factor antagonist, fish oil, omega 3-fatty acid, Although medicines, such as histamine, an antagonist, a HMG-CoA reductase depressant, SERAMIN, a serotonin prevention antibody, a CHIOPURO teeth depressant, bird MAZORUPIRI Demin, and interferon, are mentioned, it should not be limited to these.

[0045]

[Effect of the Invention]The metal stent which provided the polymer film cover of this invention can prevent the bad influence which it has on a human body organization like the antithrombotic action by metal. a polymer film cover -- abbreviated, since the detailed hole was provided at the uniform interval, Without a blood vessel being tapered by multiplication of endothelial cells, since endothelial cells enter inside the main part of a metal stent and cover the inner surface of the main part of a metal stent, since the inner surface of the main part of a metal stent also becomes some body tissues, biocompatibility can be given to the main part of a metal stent. abbreviated -- by providing a detailed hole at a uniform interval, endothelial cells can enter uniformly inside the main part of a metal stent, and can cover uniformly the inner surface of the main part of a metal stent. By the human body part and organization which insert the main part of a metal stent, this interval and the size of a detailed hole can be chosen, and the polymer film cover which narrowed the interval and enlarged the detailed hole can be chosen and used by the prosperous part of activity of endothelial cells.

[0046]If the manufacturing method of this invention is followed, the film of the polymer film cover can be quickly carried out to the main part of a metal stent efficiently. By instruction of this invention, a series of work from manufacture of a polymer film cover to punching of a detailed hole and the film of a cover can be mechanized, and it can process in large quantities. The manufacturing method indicated by this invention enabled it to provide the uniform polymer film cover of quality in the main part of a metal stent. The manufacturing method of this invention enabled continuous manufacture from manufacture of the main part of a metal stent to the film by a polymer film cover after the manufacturing process of the usual main part of a metal stent.

## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]The side view of the main part of a metal stent in the state where it was folded up for sending in in a lumen.

[Drawing 2]The side view of the main part of a metal stent in the state where it was extended.

[Drawing 3]The simple figure of the semiconductor laser system which a detailed hole punches.

[Drawing 4]As for (a), (b) is a perspective view of the metal stents by which the film was carried out with the segmentation polyurethane polymer film in which the detailed hole was punched, and the elements on larger scale showing the state of the punched detailed hole.

[Drawing 5]The perspective view of the metal stent in the state by which the film was carried out with the segmentation polyurethane polymer film in which the detailed hole was punched where it was expanded.

[Drawing 6]As for (a), (b) is a perspective view of the metal stents in which the film was further carried by gelatin in the surface of the segmentation polyurethane polymer film in which the detailed hole was punched, and the elements on larger scale showing the state of the detailed hole in which the film was carried out by gelatin.

[Drawing 7]The flowchart showing the process of manufacturing the stent in which the film was carried out by the cover strip of the polymer film.

[Explanations of letters or numerals]

10 Main part of stent

12 Excimer laser generator

14 TV monitor

16 Computer

18 Micro processing unit

19 SPU film

20 Stent

21 Coating layer

22 Mandrel for cover strips

24 Cover strip

26 Polymer fluid

28 Base material

30 Mandrel for stents

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[Translation done.]